U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-283 434

Resource Manual for Implementing the NSPS Continuous Monitoring Regulations. Manual 2 Preliminary Activities for Continuous Monitoring System Certification

Acurex Corp, Mountain View, Calif.

Prepared for

Environmental Protection Agency, Washington, D.C.

Apr 78

PB 283 434

RESOURCE MANUAL FOR IMPLEMENTING THE NSPS CONTINUOUS MONITORING REGULATIONS

Manual 2 – Preliminary Activities for Continuous Monitoring System Certification

Stationary Source Enforcement Series

EPA-340/1-78-005b
April 1978

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF ENFORCEMENT
OFFICE OF GENERAL ENFORCEMENT
WASHINGTON, D.C. 20460

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-340/1-78-005c	2.
3. RECIPIENT'S ACCESSION NO. PB283434	
4. TITLE AND SUBTITLE Resource Manual for Implementing the NSPS Continuous Monitoring Regulations. Manual 2 - Preliminary Activities for Concinuous Monitoring System Certification	5. REPORT DATE
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) F. Jaye, J. Steiner, R. Larkin	8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Acurex Corporation/Aerotherm Division 485 Clyde Avenue Mountain View, CA 94042	10. PROGRAM ELEMENT NO.
	11. CONTRACT/GRANT NO. 68-01-3158
12. SPONSORING AGENCY NAME AND ADDRESS EPA Office of Enforcement Division of Stationary Source Enforcement Washington, D.C. 20460	13. TYPE OF REPORT AND PERIOD COVERED
	14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES	

16. ABSTRACT

Manual 2 - Preliminary Activities for Continuous Monitoring Systems Certification - is one of a series of four manuals that comprise the "Resource Manual for Implementing the NSPS Continuous Monitoring Regulations." The other manuals are:

Manual 1 - Source Selection and Location of Continuous Monitoring Systems

Manual 3 - Procedures for Agency Evaluation of Continuous Monitor Data and Excess Emission Reports

Manual 4 - Source Operating and Maintenance Procedures for Continuous Monitoring Systems

Manual 2 discusses the NSPS regulations pertaining to monitor installations, agency notification requirements and performance test evaluations. The text and referenced checklists are intended to supplement the actual performance specifications.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Stationary Source Continuous Emission Monitoring New Source Performance Standards	Continuous Emission Monitoring	13 B 14 D

18. DISTRIBUTION STATEMENT Release Unlimited	19. SECURITY CLASS (This Report) Unclassified	21. NO. OF PAGES 25
	20. SECURITY CLASS (This page) Unclassified	22. PRICE HØ2 - HØ1

EPA Form 2220-1 (9-73)

EPA-340/1-78-005b

RESOURCE MANUAL FOR IMPLEMENTING THE NSPS CONTINUOUS MONITORING REGULATIONS

Manual 2 - Preliminary Activities for Continuous Monitoring System Certification

by

F. Jaye, J. Steiner, and R. Larkin

Acurex Corporation/Aerotherm Division
485 Clyde Avenue
Mountain View, CA 94042

Contract No. 68-01-3158

EPA Project Officer: Louis Paley

Division of Stationary Source Enforcement

Prepared for

U.S. ENVIRONMENTAL PROTECTION AGENCY
Division of Stationary Source Enforcement
Research Triangle Park, North Carolina 27711

April 1978

i.a

STATIONARY SOURCE ENFORCEMENT SERIES

The Stationary Source Enforcement series of reports is issued by the Office of General Enforcement, Environmental Protection Agency, to assist the Regional Offices in activities related to enforcement of implementation plans, new source emission standards, and hazardous emission standards to be developed under the Clean Air Act. Copies of Stationary Source Enforcement reports are available - as supplies permit - from the U.S. Environmental Protection Agency, Office of Administration, Library Services, MD-35, Research Triangle Park, North Carolina 27711, or may be obtained, for a nominal cost, from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161.

REVIEW NOTICE

This report has been reviewed by the Division of Stationary Source Enforcement and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

TABLE OF CONTENTS

Section		Page
A	INTRODUCTION	2-1
B	PRELIMINARY CONTINUOUS MONITOR PERFORMANCE EVALUATION ACTIVITIES	2-1
	1. Regulations	2-1
	2. Source Installation of Continuous Monitors	2-3
C	NOTIFICATION OF CONTINUOUS MONITOR SYSTEM PERFORMANCE EVALUATION TESTS	2-4
D	AGENCY OBSERVATIONS OF CONTINUOUS MONITOR SYSTEM PERFORMANCE EVALUATION TESTS	2-5
	1. Regulations	2-5
	2. Important Parameter During Performance Tests	2-6
	a. Location of the Monitor	2-6
	b. Monitor Design and Operation	2-6
	c. Design and Operation of Data Handling Systems	2-7
	d. Calibrating the Monitoring System	2-7
	e. Manual Source Testing Observations	2-9
	3. Monitoring System Malfunction	2-11
	4. Calibration and Zero Techniques	2-11
	5. F Factor Determination	2-12
	6. NO/NO_x Ratio	2-13
	7. Sulfuric Acid Plant Conversion Factor	2-15
E	CONTINUOUS MONITOR REPORT AND RECORD KEEPING REQUIREMENTS	2-15
F	CHECKLISTS FOR EVALUATING THE INSTALLATION AND SYSTEM PERFORMANCE EVALUATION TESTS	2-16

A. INTRODUCTION

Manual 2, Preliminary Activities for Continuous Monitoring System Certification, of the "Resource Manual for Implementing the NSPS Continuous Monitoring Regulations," discusses the NSPS regulations pertaining to monitor installation, agency notification requirements and performance test evaluations. The text and the referenced checklist are intended to supplement the actual performance specifications. The agency observer should pay particular attention to Section D.2 which contains a wealth of practical information regarding procedures and problems encountered during continuous monitor performance evaluations.

Manual 2 is one of a series that comprise the "Resource Manual". The other manuals are:

Manual 1 Source Selection and Location of Continuous Monitoring Systems

Manual 3 Procedures for Agency Evaluation of Continuous Monitor Data and Excess Emission Reports

Manual 4 Source Operating and Maintenance Procedures for Continuous Monitoring Systems

B. PRELIMINARY CONTINUOUS MONITOR PERFORMANCE EVALUATION ACTIVITIES

1. Regulations

The NSPS do not require that a source involve or inform an agency concerning any advance planning or installation of a monitoring system. However, communication can take place, and it is very likely that the sources will look to the local, state, or regional offices for assistance and advice in planning their continuous monitoring system installations. Experience has shown that early agency coordination and involvement with a source concerning monitors enhanced the likelihood that valid and timely data will be acquired by the source. Therefore, within the limits of the law and your manpower and resources, we encourage you to provide as much helpful support as you can give the source in the planning phase.

It would be extremely helpful, and could probably, save time and money, if the agency were to contact sources subject to NSPS at the earliest possible date and review a preperformance checklist such as the following:

- Are you familiar with the October 6, 1975, Federal Register?
- Have you ordered the proper span gases?
- Are the gases 50 percent and 90 percent of required full range?
- Is monitor location proper?
- Is there a provision for injecting span gas at the probe?
- Is analysis of span gases scheduled?
- For transmissometers, have bench-top tests been done or scheduled by the vendor (if yes, get certification)
- If the monitor is already installed are readings accurate? What problems, if any, have occurred and how have they been remedied?
- Has a detailed schedule for the week of the test been worked out?

For the most part, the average source will know little about monitoring, and will welcome your advice and guidance. Typically, a source will ask which monitoring system the Agency would approve for installation. The Agency should not recommend a particular system, but should be aware of similar sources that have installed continuous monitoring systems and suggest that the source contact some of them. Where possible, the source should be encouraged to find examples of reliable systems and examples of good performance test results.

Secondly, an Agency should indicate to the source the level of evaluation it plans to conduct on the monitoring system, so that the proper facilities will be provided in the initial installation of the system. Finally, the Agency should review the location the source has chosen for installing the monitoring system. This would prevent installation of the system in a nonrepresentative location. A friendly attitude toward information exchange will help later in the implementing of a good monitoring system. Rapport with the source will probably also provide the greatest impetus

to good monitoring practice. It may be helpful to suggest well written reports, since they will be most effective in communicating needs.

2. Source Installation of Continuous Monitors

Installing monitoring systems is generally the joint responsibility of both the source and the equipment vendor. The source will provide the representative location, mounting brackets, flanges, sampling ports, plumbing, power, etc., according to vendor specification or blueprints. The source or the vendor will then connect the monitoring system to the prepared facilities. It is important to note that a transmissometer should be tested prior to installation at the source (see Performance Specification 1). Also, some sources will need to verify the absence of stratification.

NOTE

> Section 60.13 (c)(2) states that owners or operators of monitoring systems installed before October 6, 1975 are not required to conduct the performance testing discussed in this section. These exempted systems must be upgraded or replaced and the new systems performance tested before September 11, 1979.

Prior to performance testing, the continuous monitoring system must complete 168 hours of continuous operation (referred to as the "conditioning period") as required by Paragraph (b) of 60.13:

(b) All continuous monitoring systems and monitoring devices shall be installed and operational prior to conducting performance tests under Section 60.8. Verification of operational status shall, as a minimum, consist of the following:

(1) For continuous monitoring systems references in Paragraph (c)(1) of this section, completion of the conditioning period specified by applicable requirements in Appendix B.

(2) For continuous monitoring systems references in Paragraph (c)(2) of this section, completion of 7 days of operation. The requirement for, and duration of the conditioning period was selected because:

- Many field evaluation programs have shown that several common failures occur during the first few days of operation. These problems include improper installation, plumbing mistakes, electrical failure, insufficient sample conditioning, unsuspected conditions in the effluent stream, normal equipment or component failures, poor assembly line quality control, etc.
- Operating the monitor for 1 week will give the source personnel some familiarity with the routine maintenance and functioning of the system.

Experience has shown that if a system successfully completes this preliminary week of uninterrupted operation, it is likely to operate successfully during the performance test period and thereafter, if maintained correctly.

Several operational parameters should also be quantified during this period. These may include frequency of required window cleaning, filter blowback, and some indication of expected zero and span drift. When the conditioning period is completed, the continuous monitoring system is ready for the operational test period and performance testing.

C. NOTIFICATION OF CONTINUOUS MONITOR SYSTEM PERFORMANCE EVALUATION TESTS

Paragraph 60.13 (b) states:

(b) All continuous monitoring systems and monitoring devices shall be installed and operational prior to conducting performance tests ...

Paragraph (a)(5) of Section 60.7 requires that the source provide 30-days notice to the Administrator of their intent to conduct performance tests on each monitoring system:

(a)(5) A notification of the date upon which demonstration of the continuous monitoring system performance commences in accordance with Section 60.13(c). Notification shall be postmarked not less than 30 days prior to such date.

D. AGENCY OBSERVATIONS OF CONTINUOUS MONITOR SYSTEM PERFORMANCE EVALUATION TESTS

1. Regulations

The "as-installed" performance test is the first required interaction between the agency and the source regarding the continuous monitoring system. The majority of the testing requirements are clearly spelled out in the regulations and the testing portion of the performance specifications. The specific sections are as follows:

- Performance Specification 1: Opacity Monitors
- Performance Specification 2: SO_2, NO_x Monitors
- Performance Specification 3: O_2, CO_2 Monitors

Paragraph (c) of Section 60.13 requires that the appropriate monitoring system performance tests be conducted during <u>any</u> source performance tests or within 30-days thereafter.

(c) During any performance tests required under Section 60.8 or within 30-days thereafter and at such other times as may be required by the Administrator under Section 114 of the Act, the owner or operator of any affected facility shall conduct continuous monitoring system performance evaluations and furnish the Administrator within 60-days thereof, two, or upon request, more copies of a written report of the results of such tests. These continuous monitoring system performance evaluations shall be conducted in accordance with the following specifications and procedures:

(1) Continuous monitoring systems listed within this paragraph except as provided in Paragraph (c)(2) of this section shall be evaluated in accordance with the requirements and procedures contained in the applicable performance specification of Appendix B as follows:

(i) Continuous monitoring systems for measuring opacity of emissions shall comply with Performance Specification 1

(ii) Continuous monitoring systems for measuring nitrogen oxides emissions shall comply with Performance Specification 2

(iii) Continuous monitoring systems for measuring sulfur dioxide emissions shall comply with Performance Specification 2.

(iv) Continuous monitoring systems for measuring the oxygen content or carbon dioxide content of effluent gases shall comply with Performance Specification 3.

Since the performance tests are detailed and involve simple worksheets for calculations, we will not discuss the testing routine. The following subsections are oriented toward several items that should be observed and ultimately become part of the file on a source. One purpose of these observations is to provide a background file for future evaluations. Another purpose is to appraise the overall operation of the monitoring system and the variability of the measurements to provide some information for assessing this source's monitoring records. If the source varies suddenly, the monitoring system may have difficulty following process changes in routine practice, even though it may pass the performance tests.

2. Important Parameters During Performance Tests

There are several important parameters that observers should note during the performance test of a continuous monitoring system.

a. Location of the Monitor

An observer should first note the location of the monitor in the duct or stack. He must decide whether or not the selected location meets the installation criteria of the applicable performance specification (see Section 4 of each performance specification) and whether or not a representative measurement will be made.

b. Monitor Design and Operation

A detailed flow chart of the continuous monitoring installation should be obtained from the source (or should be prepared by the observer) so that the observer is completely familiar with the individual components and operations of the system (sample acquisition, calibration, back purge, etc.). To insure that sufficient information is collected on the monitoring system, the agency should obtain a copy of the manufacutrer's operating manual for the particular type of monitor.

c. Design and Operation of Data Handling Systems

The observers should also have an operating manual for any data handling devices, particularly if complicated automatic data loggers are used. This will help him determine if the source is obtaining sufficient data and if the quarterly report format is correct. The inspector should check the operation and setpoints of any alarm systems. During the performance testing, the source's procedures for data reduction and completing quarterly reports should be reviewed. In addition, a log should be available for operating parameters, adjustments, maintenance, etc., to be used for preparing the testing report.

d. Calibrating the Monitoring System

The ultimate accuracy of a monitoring system depends heavily on the standards and techniques used for the calibration of the instrument. Three calibration techniques are commonly used for gaseous emission monitors. The first is used for extractive monitoring systems. Bottled supplies of calibration gases with known compositions are used to calibrate the entire monitoring system. The gas calibration is introduced near the inlet of the sample probe so that any dilution or absorption of the gas by the plumbing and conditioning systems prior to the gas analyzer can be detected. Section 60.13 Paragraph (d)(1) states that the manufacturer of zero and span gases should certify that their products are traceable to the National Bureau of Standards reference gases (if available). Note that the observer should verify that the proper calibration gases are being used. In addition, the source should then analyze the calibration gases in triplicate using the applicable reference methods. The observers should obtain samples of the calibration gases for analysis by agency personnel, or have the source use calibration gases that have been certified by the agency.

EPA's Environmental Monitoring and Support Lab is currently working with a calibration gas manufacturer and the National Bureau of Standards to develop traceability procedures and requirements for these calibration gases.

Nonextractive or in situ monitoring systems are typically calibrated in place by inserting certified gas cells or test cells, which are functionally equivalent to known gas concentrations, into the optical path (see Section 60.13, Paragraph (d)(2)). This test cell insertion should cause a known upscale indication on the data output device. The observer can request a copy of the procedure used to certify the concentration of gas in the sealed cell. He may also request that the cell be sent to the agency for certification. Finally, the observer may provide the source with a test cell that has been certified by the Agency. Implementation of this procedure will depend on the resources, facilities, and technical expertise of the Agency personnel. Since the calibration must be done at least once each 24-hour period, the procedure should be made simple and fast. If possible, the procedure should be built into the equipment, so that it is automatic. A lab and field evaluation of an in situ SO_2 monitor (EPA Report 650/2-75-053a) reported that the optical alignment of the instrument was affected by the chassis latch bolt tension. If the daily calibration procedure requires removing the chassis covers to manually insert a cell, the effect of these manipulations on alignment should be considered. This type of problem should be noted in the data file to alert the next observer to check on this informally during subsequent inspections. As we will point out several times in this section, the observations you make and the notes you take during performance testing will be the primary source of information for the next observer.

Section 60.13, Paragraph (d)(3) explains the calibration requirements for opacity monitors. An opacity monitor is usually calibrated using certified neutral density filters. These filters look like a greyish piece of exposed film and absorb light at a wide wavelength band that is equivalent to a fixed opacity. They may be inserted into the monitoring system either by hand or automatically. The observer should obtain a copy of the filter certification procedure or request the source to send the filters, prior to use, to the Agency for an independent check using a well-collimated, photopic transmissometer of known linearity. The observer may also provide the source with an Agency-certified set of filters. The inspector should verify that the filters are large enough to attenuate the entire light beam of the

transmissometer. Again, any pertinent observations regarding the time required and difficulty associated with using these filters should be recorded by the inspector.

The time stability of these filters is quite good if they are not grossly mishandled, scratched, or exposed to chemicals when evaluating calibration, span, zero, and general monitor performance. Be sure to consider the entire system, including data handling equipment over the same averaging time period required by the standard (i.e., a 6-minute average for opacity).

e. Manual Source Testing Observations

The gaseous pollutant continuous monitoring system must be checked against the applicable reference method. The observer should inspect the manual sampling train to insure that it meets the specifications of the reference method (heated probe, proper number of impingers, proper absorption solutions, etc.). Secondly, the observer should verify that components, such as the dry gas meter in the SO_2 train, have been properly calibrated. Thirdly, the sampling train should be checked for leaks before the test. For extractive monitoring systems, the probe tip of the manual sampling train should be adjacent to the monitoring system's probe tip. Multipoint extractive systems will require manual traverses to points adjacent to each probe inlet using the reference method. Since in situ monitoring systems give an integrated rating of the concentration across the duct or stack, the manual train also must traverse the duct or stack in the same direction to obtain an integrated concentration. Care must be taken not to insert the probe of the manual train into the light beam. At the conclusion of the reference test, the observer may request that a portion of the collected sample be sent to the agency for independent analysis. The sample and averaging periods for the reference tests and continuous monitors should be identical. It is important to note that if the bases for the continuous monitoring system and the reference method are not the same, then a moisture correction factor must be applied to either the monitoring system data or the reference method data. The moisture correction factor must be determined by conducting moisture tests concurrent with the reference method testing period. Finally,

certain sources (fossil fuel-fired steam generators, sulfuric acid plants, nitric acid plants) require additional measurements during the reference method tests to convert the continuous monitoring data to units of the standard. The observer should become familiar with these meathods (e.g., the Reich test) as well as the reference methods. Generally speaking, the most important point to watch for is that the manual reference tests and the analyzer tests are done over identical time periods with the two probe tips near each other.

During performance testing, the meaning of relative accuracy and calibration error can be confused. The observer should be aware of the difference and check the source's technique for computing these values. The calibration error of extractive monitors is computed by comparing measurements of calibration gas concentrations to the actual calibration gas concentrations. With nonextractive monitors (in situ), the measurement is determined by comparing the calibration measurements to the actual concentration values of calibration gas cells. NSPS Performance Specification 2 requires the source to:

> Report the calibration error (the sum of the absolute value of the mean difference and the 95-percent confidence interval) as a percentage of each respective calibration gas concentration. In equation form:

$$\text{Calibration error} = \frac{\text{Mean } |\text{Difference}| + 95\% \text{ C.I.}}{\text{Average Calibration Gas Concentration}} \times 100$$

The relative error compares the analyzer's measurement of the source's stack gas concentrations to the concentrations measured by the applicable EAP Reference Method (either Method 6 or 7). NSPS Performance Specification 2 requires the source to report relative accuracy:

> ... as the sum of the absolute value of the mean difference and the 95-percent confidence interval of the difference expressed as a percentage of the mean reference method value. In equation form:

$$\text{Accuracy} = \frac{\text{Mean of the } |\text{difference}| + 95\% \text{ C.I.}}{\text{Mean reference method value}} \times 100$$

3. Monitoring System Malfunctions

The conditioning period occurs before the performance test so that any installation or design errors can be identified and fixed. Several weeks of operation before the performance test will minimize failures. The ability of source personnel to recognize, diagnose, and fix these failures gives some indication of their attitude and proficiency with regard to continuous monitoring. This is a very important observation that the observer should record in the source file.

The failures that would probably occur during these tests are associated with plugging particulate filters on extractive probes (inadequate purge cycle), window cleaning for opacity or in situ monitors (poor purge blowers or installation), excessive zero drift due to voltage fluctuations or temperature variations, calibration drift because of the chemical or physical degradation of the sensor element, and monitor misalignment due to vibration or poor installation.

To the Agency, the most important aspect of a failure during performance testing is how it is identified and fixed. If the vendor representative is the only person who knows that the system has failed, then (at least initially) the monitoring system may not be attended to effectively when the representative leaves. If it is a subtle failure and the operating personnel identify it or are interested in the diagnosis and correction, the system will probably live a long and successful life, experience very little downtime, and produce meaningful data.

4. Calibration and Zero Techniques

An important observation during performance testing involves the complexity of the zero and calibration procedures. In most sources, the care and maintenance of the monitoring system will ultimately fall upon one or more of the plant maintenance technicians. If the source is large enough, these technicians may be electricians or mechanics. At other sources, however, skilled personnel may not be available. If the calibration or zero sequence is more complex than turning a valve or two, actuating a switch, or turning a knob until a zero or span reading matches a preset value, it probably cannot be routinely accomplished at a plant that does not have

skilled personnel available. It should be noted whether adjustments, including zero and calibration, are made by source personnel or by the vendor representative. The vendor representative can probably make the adjustments quickly and efficiently -- thus increasing the probability that the equipment will meet specifications. However, the reliability of the routine monitoring data will depend on whether the source personnel can do it on a daily basis. The most critical item is whether the procedure is well defined and simple enough for a person with normal plant maintenance skills to accomplish routinely. It is important that the person who follows the maintenance directions can perform the calibration correctly.

Each source is likely to have a senior engineer responsible for communicating emission information to the Agency. The more this individual knows and cares about the monitoring system, the more reliable the data is likely to be. This individual's involvement with the monitoring system should be noted by the observer. Finally, any potential problems, "tricks", etc., that are part of the procedure should be noted for information and checkup on future evaluations.

5. F Factor Determination

The F factor was developed by EPA to eliminate the need for measuring effluent volumetric flowrate and heat input rate at fossil fuel-fired steam generators. Simply stated, the F factor is the ratio of the volume of dry flue gases generated to the calorific value of the fuel combusted. Section 60.45, Paragraph (f)(4) describes the ASTM methods and formulas used to determine the F factor for a specific fuel. EPA has calculated F factors for various fossil fuels and found that they vary by no more than +3 percent within a given fuel category and, hence, can be considered a constant. Section 60.45, Paragraph (f)(6) lists F factors for various types of fossil fuels. The source has the option to calculate an F factor or use the F factor calculated by EPA. Section 60.46, Paragraph (f)(3)(i) and (ii) describes how the O_2 sample should be taken.

The F_c factor is the ratio of the volume of carbon dioxide generated to the calorific value of the fuel combusted. The F_c factor can be used in place of the F factor if a source feels it is more convenient to measure CO_2 rather than O_2. The advantage of this method is that the emission ratio may be determined from wet basis concentration measurements without recalculation of the F_c factor.

It should be noted that, without exception, when a CO_2 monitor is installed after a limestone scrubber, the F_c factor should be increased by 1 percent. The correction factor counteracts the negative bias in pollutant emission (E) caused by CO_2 production in a limestone scrubber. The percent correction corresponds to the "extreme case" of CO_2 production.

As with the F factor, the EPA has determined that for a given fuel category the F_c factor varies by no more than ±5.9 percent and hence can be considered a constant. Of course, the source has the choice of using either the EPA published F_c factor or a factor derived from their particular fuel.

The regulations do not specify the number of times the F factor or F_c factor should be determined. The frequency may be specified at a later date during the proposed studies on fuel sulfur analysis. In the absence of further information, the factors should be determined at least once a day during the performance testing period.

It is important to note that when a source fires combinations of fossil fuels, the consumption of each fuel should be measured during each testing period. Measurement methods must be confirmed by a material balance over the steam generation system. The F or F_c factor must be approved by the administrator when fossil and nonfossil fuels are fired.

6. <u>NO/NO_x Ratio</u>

Most gaseous emissions that are monitored are single compounds, such as SO_2, CO, CO_2, and O_2, so the monitoring euqipment can be straightforward. The NO_x monitoring requirements differ, on a source-by-source basis, according to the varying ratios of NO to NO_2 in each source class. Nitrogen is a multivalent compound and may form several oxides. Of the oxides, nitrogen dioxide (NO_2) and nitric oxide (NO) are considered to be harmful air pollutants

and are controlled under NSPS. Section 60.45(c) requires fossil fuel steam generators to monitor the NO_x ($NO + NO_2$) emissions, which are mostly nitric oxide (NO), with NO_2 being from 1 to 5 percent of the total. For these sources, NO is the specified calibration and test gas. The preamble to the regulations in the October 6, 1975 Federal register states that sources might monitor only NO and apply a correction factor to all later data to adjust for the small NO_2 content. Comments made to the administrator pointed out that NO-only systems were less expensive than NO/NO_2 monitoring systems. Such systems would still be subject to the ±20-percent relative accuracy requirement of Performance Specification 2. However, the data reported could be multiplied by a correction factor determined by the performance tests (e.g., $1.03 \times NO = NO_x$) to yield the emission values. This discussion is found in 40FR46253 and is <u>not</u> found anywhere in the regulations or the Performance Specifications.

EPA's field experience with most steam generation has shown that the NO/NO_2 ratios stay relatively constant during periods of steady operation with a particular fuel. The coal burners tend to produce higher absolute levels of NO, with the NO_2 remaining at about 3 percent of the total. Gas fired units generally produce lower total levels, with as high as 8-percent NO_2 being measured occasionally. This ratio of NO to NO_2 can be affected by various parameters, such as excess air and plant load. However, even at extremes, the ratio does not change more than 50-percent within a given facility. (A plant with a nominal 3-percent NO_2 content may vary from 1.5 to 4.5 percent of the total NO_x.)

The situation is reversed for nitric acid facilities. In an uncontrolled source the major emission is NO_2 (representing unabsorbed acid). Newer plants use hydrogen or ammonia to reduce the actual NO_x emission level. Depending on control system operation and stability, the resultant emissions can range from mostly NO to mostly NO_2 with traces of ammonia. Since the major emission is NO_2 Section 60.73 requires that the calibration gas used for the monitoring system be nitrogen dioxide (NO_2).

The correction factor shall be calculated by dividing the reference method test data averages by the monitoring data averages to obtain a ratio

expressed in units of the applicable standard. This ratio, or correction factor, shall be recalculated when any source performance testing is done.

7. Sulfuric Acid Plant Conversion Factor

Section 60.84, Paragraph (b) defines the conversion factor to be used to convert the continuous monitoring system data to the units of the applicable standard. To calculate this conversion factor, the inlet SO_2 concentration to the converter must be determined using methods such as the Reich test at least three times per day. For plants that use air injection to cool the gases between passes through different stages of the converter, appropriate corrections must be made, subject to the Administrator's approval.

The Reich test is a simple wet chemical test similar to the Orsat test for CO_2, O_2, and CO. A known volume of gas from the inlet to the converter is withdrawn into a burette. The SO_2 in the gas is then passed through 0.1 N iodine solution, which absorbs the SO_2. The volume of SO_2 absorbed is measured and the concentration of SO_2 is calculated. To insure that the tests are being performed correctly, the observer should become familiar with the methods used to measure the inlet SO_2 concentration.

E. CONTINUOUS MONITOR REPORT AND RECORD KEEPING REQUIREMENTS

Paragraph (c) of Section 60.13 requires that the owner or operator of a source shall provide the Administrator with two (or more if requested) copies of a written report covering the monitoring system performance evaluations within 60 days of completing the tests. The requirements for this report are not specified, but the report should include the following information to show compliance with the performance specifications:

- Data worksheets, as shown in the performance applications (including sample calculations)
- Worksheets from the reference method tests conducted for comparison (including sample calculations)
- Any required notations or records, such as records of maintenance, adjustments, failures, etc., of the monitoring system during the test period

- The factor used to convert the measured emissions to the units of the applicable standard (including sample calculations)
- Plant production rate during the testing period
- A narrative of the entire testing period (including equipment and procedures used), which should give a reader a good understanding of the entire test as it actually occurred
- Certification or calibration records of span and calibration gases, test equipment, etc.

All this data should become part of the monitoring file for each source, and should be available for the observer to review before his next visit to that source.

More specific details on the monitor reporting requirements are given in Section 9 of Performance Specification 1 and Section 7 of Performance Specifications 2 and 3.

F. CHECKLISTS FOR EVALUATING THE INSTALLATION AND SYSTEM PERFORMANCE EVALUATION TESTS

This section contains a checklist to be used as an aid to the Agency observer when evaluating a source's continuous monitor certification program. Each question in the checklist has been referenced to the appropriate part of the Manual text.

a. Installation	Subsection References	Yes	No	NA	Notes
• See Section II, monitor location checklist	—				
• Was the system installed prior to October 6, 1975? If so, the source is exempted from this section until upgraded or replaced before September 11, 1979.	B.2				

	Subsection References	Yes	No	NA	Notes
b. Notification					
• Is the performance testing scheduled at least 30 days after the notification?	C.				
• Has the 168-hour conditioning period been successfully completed?	C.				
• What problems were noted during the preliminary period and how were they fixed?	C.				
c. Performance Testing					
• Were the required EPA reference method tests carried out according to good sampling practice and procedure?	D.2.e				
• Were the zero and span adjustments made on the monitoring system in accordance with the manufacturer's or source's written procedures?	D.4				
• Did the source or the system vendor make the required adjustments?	D.2.d				
• Were the calibration materials current and properly documented or certified?	D.2.d				

	Subsection References	Yes	No	NA	Notes
• Were the calibration materials analyzed, certified, or traceable to NBS?	D.2.d				
• Were tests made to determine whether the monitor location is correct stratification, etc.?	D.2.a				
• Is a functional system diagram available for both the monitor and data handling subsystem?					
• Is the monitor in a stack or duct?	D.2.a				
• How difficult is the zero or calibration procedure?	D.4				
• Can the source personnel conduct these procedures?	D.4				
• Were there any alignment or adjustment problems during the testing?	D.3				
• Were malfunctions identified quickly and fixed?	D.3				
• How does the source determine its "F" factor?	D.5				
• Does the source (if necessary) monitor total NO_x or use a NO/NO_2 ratio in converting data? How is this ratio determined?	D.6				

	Subsection References	Yes	No	NA	Notes
• How were the nitric acid and sulfuric acid plant conversion factors computed?	D.7				
• Are all operating parameters, adjustments, source operations, maintenance, etc. recorded in a log to be used to prepare the testing report?	D.8				
• Is the procedure for data reduction and quarterly reports established?	D.8				
• If automated, is software documentation included?	D.8				
• Can the report format be interpreted easily?	D.8				
• Who reviews and is responsible for submitting the report?	D.8				
• Does the source know when and where to send the report?	D.8				